CLAIMS:

1. In an optical disc drive apparatus, of a type comprising:
- rotating means defining a rotating axis for an optical disc;
- optical scanning means for scanning an optical disc with a light beam, said optical scanning means comprising a displaceable objective lens for focussing the light beam onto said optical disc, said objective lens being displaceable in axial direction and capable of being pivoted about an axis directed in tangential direction;
a method for measuring tilt in a measuring location of the optical disc;
the method comprising the steps of:
by pivoting and axially displacing the objective lens, bringing said objective lens to a first focus measuring location such as to focus the light beam in a first anchor point having substantially the same angular coordinate φ as said measuring location and having a small radial distance $\Delta r1$ from said measuring location;
by displacing and pivoting the objective lens, bringing said objective lens to a second focus measuring location such as to focus the light beam in a second anchor point having substantially the same angular coordinate φ as said measuring location and having a small radial distance $\Delta r2$ from said measuring location;
said first and second anchor points being located on opposite sides of said measuring location;
the method further comprising the step of calculating tilt in said measuring location from the coordinates of said two focus measuring locations of said objective lens.

2. Method according to claim 1, comprising the steps of:
bringing the objective lens to an initial focus position such as to focus the light beam in said measuring location;
with respect to said initial focus position, pivoting the objective lens over a first angle towards smaller radius;
displacing the objective lens axially over a first axial distance such that the optical beam is again focused on the disc;
with respect to said initial focus position, pivoting the objective lens over a second angle

towards larger radius;

displacing the objective lens axially over a second axial distance such that the optical beam is again focused on the disc.

3. Method according to claim 2, wherein tilt of the measuring location is calculated in accordance with the formula:

$$\tan\theta(r,\phi) = (f\cdot\cos(\Delta\psi_1)+\Delta z_1-(f\cdot\cos(\Delta\psi_2)-\Delta z_2))/(f\cdot\sin(\Delta\psi_1)+f\cdot\sin(\Delta\psi_2))$$

4. Method according to claim 2 or 3, wherein the first angle is equal to the second angle.

5. Method according to claim 1, comprising the steps of:

bringing the objective lens to an initial focus position such as to focus the light beam in said measuring location;

with respect to said initial focus position, axially displacing the objective lens over an axial distance towards the disc;

pivoting the objective lens over a first pivot angle towards smaller radius such that the optical beam is again focused on the disc;

pivoting the objective lens over a second pivot angle towards larger radius such that the optical beam is again focused on the disc.

6. Method according to claim 5, wherein tilt of the measuring location is calculated in accordance with the formula:

$$\tan\theta(r,\phi) = (\cos(\Delta\psi_1)-\cos(\Delta\psi_2))/(\sin(\Delta\psi_1)+\sin(\Delta\psi_2))$$

7. Method according to any of the previous claims, wherein the measurements are performed while the disc is being rotated, such that measurement results are obtained for a plurality of points located at a first radius, and these measurement results are stored in a memory in correlation to the corresponding angular coordinate; measurement results are obtained for a plurality of points located at a second radius, and these measurement results are stored in a memory in correlation to the corresponding angular coordinate; and the tilt at at least one location at an intermediate radius and having a certain angular coordinate is calculated from the measurement results stored in said memories.

8. Optical disc drive apparatus, comprising:

rotating means defining a rotating axis for an optical disc;

optical scanning means for scanning an optical disc with a light beam, said optical scanning means comprising:

- a light beam generating means for generating a light beam;
- a displaceable objective lens for focussing the light beam onto said optical disc;

the apparatus further comprising:

radial actuator means for radially displacing said objective lens;

axial actuator means for axially displacing said objective lens;

pivot actuator means for pivoting said objective lens;

control means for controlling said radial actuator means, said axial actuator means, and said pivot actuator means;

said control means being designed for measuring tilt in a measuring location of an optical disc by:

-- by pivoting and axially displacing the objective lens, bringing said objective lens to a first focus measuring location such as to focus the light beam in a first anchor point having substantially the same angular coordinate φ as said measuring location and having a small radial distance $\Delta r1$ from said measuring location;

-- by pivoting and axially displacing the objective lens, bringing said objective lens to a second focus measuring location such as to focus the light beam in a second anchor point having substantially the same angular coordinate φ as said measuring location and having a small radial distance $\Delta r2$ from said measuring location, said first and second anchor points being located on opposite sides of said measuring location;

-- calculating tilt in said measuring location from the coordinates of said two focus measuring locations of said objective lens.

9. Disc drive apparatus according to claim 8, wherein said control means is designed to:

-- activate said radial actuator means and said axial actuator means in order to bring the objective lens to an initial focus position such as to focus the light beam in said measuring location;

-- activate said pivot actuator means in order to pivot the objective lens over a first pivot angle towards smaller radius with respect to said initial focus position;

-- activate said axial actuator means in order to axially displace the objective lens over a first

axial distance such that the optical beam is again focused on the disc;

-- activate said pivot actuator means in order to pivot the objective lens over a second pivot angle towards larger radius with respect to said initial focus position;

-- activate said axial actuator means in order to axially displace the objective lens over a second axial distance such that the optical beam is again focused on the disc.

10. Apparatus according to claim 9, wherein said control means is designed to calculate tilt of the measuring location in accordance with the formula:

$$\tan\theta(r,\phi) = (f\cdot\cos(\Delta\psi_1)+\Delta z_1-(f\cdot\cos(\Delta\psi_2)-\Delta z_2))/(f\cdot\sin(\Delta\psi_1)+f\cdot\sin(\Delta\psi_2))$$

11. Apparatus according to claim 9 or 10, wherein the first angle is equal to the second angle.

12. Disc drive apparatus according to claim 8, wherein said control means is designed to:

-- activate said radial actuator means and said axial actuator means in order to bring the objective lens to an initial focus position such as to focus the light beam in said measuring location;

-- activate said axial actuator means in order to axially displace the objective lens over an axial distance towards the disc;

-- activate said pivot actuator means in order to pivot the objective lens over a first pivot angle towards smaller radius such that the optical beam is again focused on the disc;

-- activate said pivot actuator means in order to pivot the objective lens over a second pivot angle towards larger radius such that the optical beam is again focused on the disc.

13. Disc drive apparatus according to claim 12, wherein said control means is designed to calculate tilt of the measuring location in accordance with the formula:

$$\tan\theta(r,\phi) = (\cos(\Delta\psi_1)-\cos(\Delta\psi_2))/(\sin(\Delta\psi_1)+\sin(\Delta\psi_2))$$

14. Apparatus according to any of claims 8-13, wherein the control unit is designed to:

-- activate the rotating means such as to rotate the disc;

-- activate said radial actuator means in order to bring the objective lens to an initial radial position;

-- activate said axial actuator means in order to bring the objective lens to an initial focus position;

-- activate said pivot actuator such as to pivot the objective lens over a first angle towards smaller radius;

-- activate said axial actuator means in order to obtain and maintain a focus condition;

-- sample the focal control signal over at least one revolution of the optical disc;

-- store the sampled values in a memory, in correlation to the angular position at which the focal control signal was sampled;

-- activate said pivot actuator such as to pivot the objective lens over a second angle towards larger radius;

-- activate said axial actuator means in order to obtain and maintain a focus condition;

-- sample the focal control signal over at least one revolution of the optical disc;

-- store the sampled values in a memory, in correlation to the angular position at which the focal control signal was sampled;

-- calculate the tilt at a location at said initial radius, using the stored values.

15. Apparatus according to any of claims 8-13, wherein the control unit is designed to:

-- activate the rotating means such as to rotate the disc;

-- activate said radial actuator means in order to bring the objective lens to an initial radial position;

-- activate said axial actuator means in order to bring the objective lens to an initial focus position;

-- activate said axial actuator means in order to axially displace the objective lens over a distance towards the disc;

-- activate said pivot actuator in a first direction in order to obtain and maintain a focus condition;

-- sample the pivot control signal over at least one revolution of the optical disc;

-- store the sampled values in a memory, in correlation to the angular position at which the pivot control signal was sampled;

-- activate said pivot actuator in a second direction in order to obtain and maintain a focus condition;

-- sample the pivot control signal over at least one revolution of the optical disc;

-- store the sampled values in a memory, in correlation to the angular position at which the

pivot control signal was sampled;

-- calculate the tilt at a location at said initial radius, using the stored values.

16. In an optical disc drive apparatus, of a type comprising:

- rotating means defining a rotating axis for an optical disc;

- optical scanning means for scanning an optical disc with a light beam, said optical scanning means comprising a displaceable objective lens for focussing the light beam onto said optical disc, said objective lens being displaceable in axial direction and capable of being pivoted about an axis directed in tangential direction;

a method for setting an operational pivot angle of the objective lens;

the method comprising the steps of:

[a] selecting an initial pivot offset;

[b] bringing the objective lens to an initial focus position (x_0, 0, z_0, ψ_0);

[c] with respect to said initial focus position (x_0, 0, z_0, ψ_0), pivoting the objective lens over a first angle towards smaller radius to a position (x_0, 0, z_0, $\psi_0-\Delta\psi_1$);

[d] displacing the objective lens axially over a first axial distance such that the optical beam is again focused on the disc;

[e] with respect to said initial focus position (x_0, 0, z_0, ψ_0), pivoting the objective lens over a second angle towards larger radius to a position (x_0, 0, z_0, $\psi_0+\Delta\psi_2$), wherein the second angle is equal to said first angle;

[f] displacing the objective lens axially over a second axial distance such that the optical beam is again focused on the disc;

[g] comparing said first axial distance with said second axial distance;

[h1] if said first axial distance is not, within a certain limit, substantially equal to said second axial distance, readjust the pivot offset and repeat steps [b]-[g];

[h2] if said first axial distance is substantially equal to said second axial distance, set the operational pivot angle of the objective lens on the basis of the current value of the pivot offset.

17. In an optical disc drive apparatus, of a type comprising:

- rotating means defining a rotating axis for an optical disc;

- optical scanning means for scanning an optical disc with a light beam, said optical scanning means comprising a displaceable objective lens for focussing the light beam onto said optical

disc, said objective lens being displaceable in axial direction and capable of being pivoted about an axis directed in tangential direction;

a method for setting an operational pivot angle of the objective lens;

the method comprising the steps of:

[a] selecting an initial pivot offset;

[b] bringing the objective lens to an initial focus position (x_0, 0, z_0, ψ_0);

[c] with respect to said initial focus position (x_0, 0, z_0, ψ_0), axially displacing the objective lens over an axial distance towards the disc;

[d] pivoting the objective lens over a first pivot angle towards smaller radius to a position (x_0, 0, z_0, ψ_0-$\Delta\psi_1$), such that the optical beam is again focused on the disc;

[e] pivoting the objective lens over a second pivot angle towards larger radius to a position (x_0, 0, z_0, ψ_0+$\Delta\psi_2$) such that the optical beam is again focused on the disc;

[f] comparing said first pivot angle with said second pivot angle;

[g1] if said first pivot angle is not, within a certain limit, substantially equal to said second pivot angle, readjust the pivot offset and repeat steps [b]-[f];

[g2] if said first pivot angle is substantially equal to said second pivot angle, set the operational pivot angle of the objective lens on the basis of the current value of the pivot offset.

18. Method according to claim 16 or 17, wherein the operational pivot angle of the objective lens is set to be equal to the current value of the pivot offset.

19. Method according to claim 16 or 17, wherein the operational pivot angle of the objective lens is set on the further basis of an optimal relationship between the operational pivot angle and the tilt of the disc.

20. Optical disc drive apparatus, comprising:

rotating means defining a rotating axis for an optical disc;

optical scanning means for scanning an optical disc with a light beam, said optical scanning means comprising:

- a light beam generating means for generating a light beam;
- a displaceable objective lens for focussing the light beam onto said optical disc;

the apparatus further comprising:

radial actuator means for radially displacing said objective lens;

axial actuator means for axially displacing said objective lens;

pivot actuator means for pivoting said objective lens;

control means for controlling said radial actuator means, said axial actuator means, and said pivot actuator means;

said control means being designed for setting an operational pivot angle of the objective lens by:

[a] selecting an initial pivot offset;

[b] activating said radial actuator means and said axial actuator means in order to bring the objective lens to an initial focus position (x_0, 0, z_0, ψ_0);

[c] activating said pivot actuator means in order to pivot the objective lens over a first pivot angle towards smaller radius to a position (x_0, 0, z_0, ψ_0-$\Delta\psi_1$);

[d] activating said axial actuator means in order to axially displace the objective lens over a first axial distance such that the optical beam is again focused on the disc;

[e] activating said pivot actuator means in order to pivot the objective lens over a second pivot angle towards larger radius to a position (x_0, 0, z_0, ψ_0+$\Delta\psi_2$), wherein the second angle is equal to said first angle;

[f] activating said axial actuator means in order to axially displace the objective lens over a second axial distance such that the optical beam is again focused on the disc

[g] comparing said first axial distance with said second axial distance;

[h1] if said first axial distance is not, within a certain limit, substantially equal to said second axial distance, readjust the pivot offset and repeat steps [b]-[g];

[h2] if said first axial distance is substantially equal to said second axial distance, set the operational pivot angle of the objective lens on the basis of the current value of the pivot offset.

21. Optical disc drive apparatus, comprising:

rotating means defining a rotating axis for an optical disc;

optical scanning means for scanning an optical disc with a light beam, said optical scanning means comprising:

- a light beam generating means for generating a light beam;
- a displaceable objective lens for focussing the light beam onto said optical disc;

the apparatus further comprising:

radial actuator means for radially displacing said objective lens;

axial actuator means for axially displacing said objective lens;

pivot actuator means for pivoting said objective lens;

control means for controlling said radial actuator means, said axial actuator means, and said pivot actuator means;

said control means being designed for setting an operational pivot angle of the objective lens by:

[a] selecting an initial pivot offset;

[b] activating said radial actuator means and said axial actuator means in order to bring the objective lens to an initial focus position (x_0, 0, z_0, ψ_0);

[c] activate said axial actuator means in order to axially displace the objective lens over an axial distance towards the disc;

[d] activate said pivot actuator means in order to pivot the objective lens over a first pivot angle towards smaller radius to a position (x_0, 0, z_0, ψ_0-$\Delta\psi_1$), such that the optical beam is again focused on the disc;

[e] activate said pivot actuator means in order to pivot the objective lens over a second pivot angle towards larger radius to a position (x_0, 0, z_0, ψ_0+$\Delta\psi_2$) such that the optical beam is again focused on the disc;

[f] comparing said first pivot angle with said second pivot angle;

[g1] if said first pivot angle is not, within a certain limit, substantially equal to said second pivot angle, readjust the pivot offset and repeat steps [b]-[f];

[g2] if said first pivot angle is substantially equal to said second pivot angle, set the operational pivot angle of the objective lens on the basis of the current value of the pivot offset.